Assessing Availability of Facilities, Infrastructure and Resources

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"It is much easier to put existing resources to better use, than to develop resources where they do not exist."——George Soros

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Key Points

- Introduction and Defining the scope of the study
- Making a timeline
- Lab and other facilities in your own institution. Personnel to help
- Multidisciplinary work, and outsourcing within the country
- Facilities for data maintenance and management
- International collaboration
- Animal research

Introduction

A Thesis should not be the last stop in education—rather it is the runway to begin lifelong meaningful research whether it is in clinical or basic sciences! With rapid expansion of the internet and ancillary tools for acquiring and disseminating information, the possibilities of doing world-class studies in the remotest corners of the world became a reality. Despite this potential, many studies are never considered or are abandoned for lack of local infrastructure. Hence assessing the availability of facilities, infrastructure and resources is an important component of finalising a thesis topic, or once decided, the first worry which confronts us! Quite frequently questions regarding these can be raised by the scientific committee or the institutional review board even at the time of approving the project. Thus a thorough understanding of infrastructure will go a long way in ensuring a smooth conduct of the thesis. Whilst many resources are available for structured formats of a thesis [1], few resources explore the avenues to explore resources! Besides, lack of infrastructure is frequently cited as a major problem perceived by potential medical researchers [2]. Despite availability of better facilities—researchers and guides continue to perceive lack of infrastructure, resources and time as an impediment to conducting research [3].

Defining the Scope of the Study

A critical step in conducting a successful study is to identify the scope of the study. The scope of the study basically means all the things that will be covered by the study. Unless a study defines a clear scope, it will creep outwards and the milestones skip out of reach. The scope helps researches to stay focussed on the issue at hand and not divert resources away from the problem at hand.

1. Identify the problem and creation of a problem statement. The first step is to identify the problem which needs to be studied. The problem(s) are identified by individuals with a deeper knowledge of the field. Once the problem is identified, data regarding its prevalence needs to be collected especially whether other researchers around the world have found this problem and how did they

circumvent it. Such individuals can be contacted, to have a better understanding of the problem. In addition, a thorough understanding of the field of study is also important.

2. Setting the boundaries: Fence in all the things that will be covered by the research. Clearly define what end points are hoped to be achieved by the study. The researchers must enlighten themselves on all the background aspects of the project and the objectives proposed to be achieved. In addition, it would be wise to identify potential limitations of the study beforehand itself. There must be clear instructions to stick to the previously agreed objectives and not stray into areas which are not primarily covered by the research. Such activities are common as the researcher stumbles upon a new finding and devotes time and energy into that, thereby losing track of the main picture. One must not lose the forest for the trees.
3. Creating a strategy: Once the milestones are defined, a strategy for achieving these must be in place. A general proposal on how to reach the milestones and whether these are reasonable and easily achievable. It is important alongside to ensure that budget and resource allocation has been looked into.

Timeline Creation

A well-designed project implementation schedule clarifies and describes what the project should deliver and within what time-frames. It is the beating heart of every project—captures the essence of the what the project will achieve.

Dividing the project into multiple phases/multiple discrete subtasks may prove useful. Audit and control implementation of each project phase is to define checkpoints (the key milestones) to be conducted on a regular basis during the implementation process. Responsibilities must be clearly allocated. It is possible that the project faces unanticipated delays and may fall out of sync with the timeline. Revision of the time line can be accepted provided it does not stretch too far from the initial estimates.

Facilities, Infrastructure and Resources

A major issue in choosing a research project or topic is the feasibility. Of course funding is a major limiting factor. Equally important is to ensure that the facilities exist to carry out the thesis or project; and resources are available or can be arranged by the researcher or the guide.

Resources include work area, equipment, library access, and human resources (leader, peers, technical assistants and availability of students) [4]. Colleagues serve as a source of knowledge, skill, expertise, emotional support, stimulation and reinforcement, thereby providing the right milieu of research “culture”. It has been shown that research productivity improved in a better environment especially with productive colleagues around! [5].

Choice of the institution and guide is clearly critical even apart from intellectual input—prior training in research methodology is extremely useful, as is the ability to be able to get work done cohesively within the department as well as elsewhere. Access of the guide to her own exclusive lab or the ability to arrange protected time in a different lab, can make the study easier to perform. The presence of adequate infrastructure to carry out the project is paramount to the conduct of the research. Should the need arise, this could even be from a different establishment or institution.

This assessment would include help and liaising with laboratories, other ancillary departments and also the technical staff who are able to provide dedicated time for the thesis. Availability under the same roof, is undoubtedly an asset and likely to increase productivity, but its absence should not hinder the research quality. In assessment of infrastructure it is extremely important to look for solutions, and not just list out potential problems. A good research guide who is actively involved in the field of study could help the candidate search for additional research facilities in other centres.

For facilities in your own Institution—In case the research project entails a substantial component outside the core competency of the researcher or her guide, it is mandatory to ensure a rapport with all the departments involved. Invariably other departments would look on most extraneous work as an additional unnecessary burden to their routine work. There are many ways to work around this. The most popular is to include the key persons as co-guides, especially if it is a major component of the thesis. If this is not possible, then at least an understanding could be effected, that these persons could be involved as authors, should a publication emerge from the study. Sometimes the suggestion that they would get help from us, should it be needed for their own research projects, may work, (almost as a quid pro quo!). At the very least, all help from personnel or departments must be acknowledged. If the thesis project indeed involves a substantial extra effort from other departments such as a laboratory, which may actually hamper their own work, then it is the responsibility of the researcher to either offer to help in the said work (as possible in Example one below) or organise and authorise extra qualified personnel for the additional work and this may need to be budgeted as well. Frequently other researchers may be working on different subjects but studying the same aspect covered by the ancillary department (e.g., a specific gene analysis in different tumors—uterine cancer from gynaecology and pancreatic cancer by a GI researcher), and a mutually acceptable way can be worked out to share costs and efforts.

Occasionally the additional department or laboratory involved may accept the extra work, but may not be able to absorb the financial implications for the use of facilities or extra expensive reagents etc. Here the onus of organising funding for this, rests with the researcher. With respect to laboratory tests, technological advances have made it possible to have modular kits to do the same tests or experiments, which can circumvent the extra effort and sometimes may reduce costs as investigations need to be batched together.

There are national and international efforts to have centralised core reference and research centres to encourage research locally or regionally and must be sought out and encouraged. It does require a few bureaucratic hurdles to be smoothened out initially, but it is well worth the effort eventually. Examples are Sanger Institute, Sheffield RNAi Screening Facility and cancer Research in UK [6], the various NIH funded centres in USA and the national reference labs all over India.

It is important to ensure that the lab or other extra personnel involved in the study, commit to extending the use of the facility for the entire expected duration of the study. This may be important to secure in departments with frequent transfers.

It is also useful to assure that the resources or database does not have competing studies involved. For example, a small endoscopic biopsy may be competing for genetic or immunohistochemical studies in one thesis and be required for electron microscopy for another topic of research! Some of these problems can be surmounted for instance in this example, by taking extra biopsies after due Ethics clearance and patient consent.

Multidisciplinary Work, and Outsourcing

Occasionally the study may primarily involve a different department—e.g., doing a meta-analysis or systematic review may utilise a statistician more than the primary researcher who may do little else other than literature review. It may then be worthwhile for the researcher to actually get trained in those modules and seek assistance only if and when required. Many online courses exist for a variety of research tools including statistics and many of them are free or highly subsidised. There can be a huge disparity in the perception of statistical help provided by their supervisors and the expectations by the researchers as shown in a recent German study [3].

It must be remembered that in certain instances it may be easier to outsource some of the components of the study to external professionals who are doing this regularly either for their own research or commercially. Examples include genetic sequencing, specialised immunochemistry, electron microscopy etc., where economies of scale may even render the test less expensive! Thus access to infrastructure and facilities can still be dictated by funding available!

If resources are used outside own institution, then it is suggested that rather than an informal arrangements, a proper Memorandum of understanding be organised with clear demarcation of extents and ownership of material data and primary sources etc. It is also good to keep the institutional ethics committee or scientific committees overseeing research and the management in the loop to avoid any ethical issues or those of trust. Suspicions are minimised if all this is sorted out up front before commencement of the study to minimise bureaucratic hurdles later on. It must be stressed that although most researchers try to look for completing their work within the confines of their own institution, all collaborations across specialties or departments or centres tend to have a better scientific and citation impact and are instinctively trusted.

Facilities for Data Management

Integrity and Maintenance of source documentation is of paramount importance, and nowhere is it more palpable, should a need arise in case of an audit (e.g., by the funding agency!!). Many Research organisations have begun to use electronic data capture options and use of electronic online databases. Although these were initially used mostly for sponsored research, they can be utilised in investigator initiated studies as well. Advantages are similar—of being able to capture data or indeed collaborate with different personnel, guide and coinvestigators etc.! Alternatively physical records may be maintained. Whatever technique is used, access must be convenient and privacy must be ensured and subject consent should be obtained for using the data subsequently. It may perhaps be easier to keep copies of original records, especially if possibility of loss of data is there, as in automatic archival or destruction of records after a set given period. In case of use of electronic data, on the contrary, the requirement may be instead to provision of WiFi access and other portable or Bluetooth enabled type gadgets! Access to communication modes is also important as dedicated or available computing devices etc. Thus it can be seen that a strategic vision is frequently required and many studies flounder for lack of it!! There is no doubt that in days to come use of electronic resources are going to improve data management exponentially [7]. Figure 1 shows the research plan and strategies adopted to implement it.

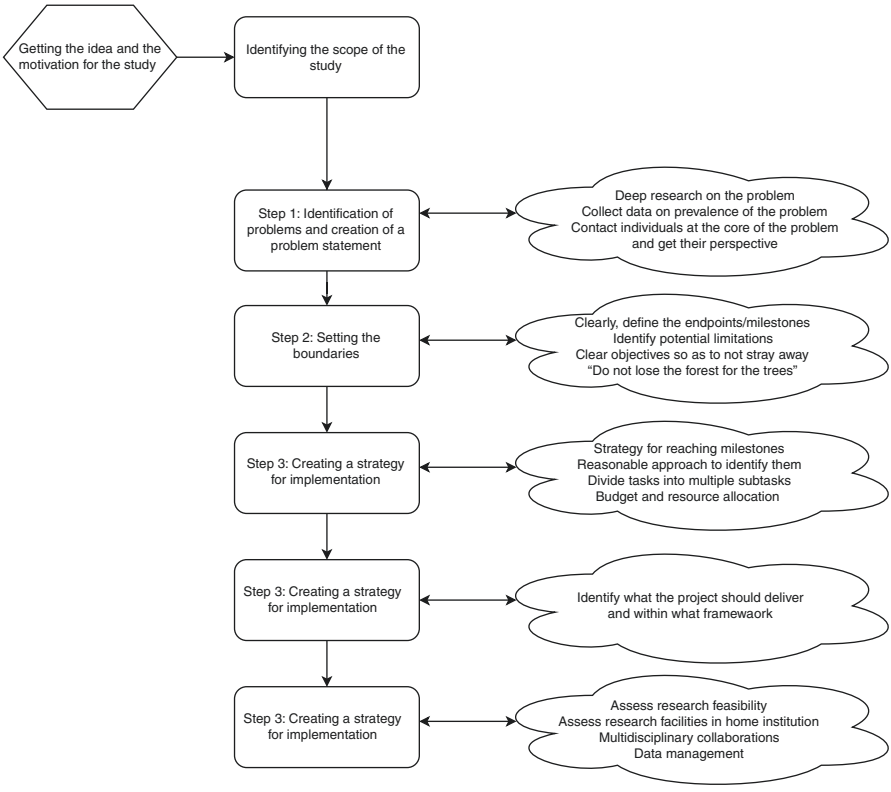

Fig. 1 Research plan and strategy to implement it

International Collaboration

Studies tend not to be as easy to conduct across countries (Unlike sponsored pharmaceutical trials!) with all the logistic hurdles that are likely with the addition of each country. For instance it is difficult to get permission to transport biological tissues outside the country. Hence it is important to be aware of all international regulation before embarking on these. Reliable communication which maintains privacy is of course even more important here.

Animal Research Facilities

Stringent regulations and animal rights activists make it easier in many countries to do research on human subjects rather than animals! Although they make a fair point in terms of need, applicability and easier slipping of norms, the ethics of such studies must be carefully looked into and are beyond the purview of this review! If used, it is important to adhere to humane principles and ensure all rules for animal protection are stringently followed.

Case Scenarios

1. A Researcher is working on prognostic value of lymphocyte subsets in a type of cancer. It involves identification of cases using aspiration cytology followed by subsequent core biopsy for immunohistochemistry. The pathology lab was extremely busy in clinical identification, typing reporting etc, and was left with little time to do the extra work. What are the possible options for the clinical researcher and possible issues involved:
   (a) Arrange for an extra lab technician who could do the additional work
   (b) "Request" or continuously "instruct" the lab that research work is equally important as clinical work!
   (c) Offer to do some part of the lab work that a clinician can do better and doesn't need too much of technical knowhow.
   (d) Monetary incentive to technicians or Change the topic
   (e) Outsource to a less busy Laboratory elsewhere
2. In a study to assess postoperative quality of life (QOL) after rectal cancer surgery, discuss the potential infrastructural problems.

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